

## CLAIMS

What is claimed is:

1. A method for determining a type of disc in an optical disc recording/reproducing device comprising a photodetector divided into at least two light receiving sections in a radial direction, comprising:
  - generating a radial push-pull signal from a difference between light receiving signals from a disk and received by the at least two light receiving sections, wherein the disk comprises one of a first disk and a second disk;
  - detecting an upper envelope signal and a lower envelope signal from the radial push-pull signal;
  - detecting a phase difference between the upper envelope signal and the lower envelope signal; and
  - distinguishing the first disk from the second disk according to a magnitude of the phase difference, wherein the second disk comprises a density higher than the first disk.
2. The method as recited in claim 1, wherein the distinguishing determines the first disk if the phase difference is greater than or equal to a reference phase difference.
3. The method as recited in claim 1, wherein the distinguishing determines the second disk if the phase difference is less than a reference phase difference.
4. The method as recited in claim 1, further comprising
  - receiving the magnitude of the phase difference and the light receiving signals and outputting servo error signals;
  - using the servo error signals to output a voltage to drive a spindle motor of the disk.
5. The method as recited in claim 1, further comprising
  - generating a first track cross signal from an envelope of an RF SUM signal, wherein the RF SUM signal is obtained by adding the light receiving signals;
  - generating a second track cross signal from an envelope of the radial push-pull signal; and
  - selectively outputting one of the first track cross signal and the second track cross signal according to the distinguishing of the first disk from the second disk.

1           6. The method as recited in claim 1, further comprising  
2           comparing the upper envelope signal with a predetermined threshold prior to  
3           detecting the phase difference; and  
4           binarizing the upper envelope signal prior to detecting the phase difference.

1           7. The method as recited in claim 1, further comprising  
2           comparing the lower envelope signal with a predetermined threshold prior to  
3           detecting the phase difference; and  
4           binarizing the lower envelope signal prior to detecting the phase difference.

1           8. A method, comprising:  
2           detecting a phase difference between an upper envelope signal and a lower envelope  
3           signal from a radial push-pull signal, wherein the radial push-pull signal is a difference  
4           between at least two light receiving signals from a disk and received by at least two light  
5           receiving sections in a photodetector, wherein the disk comprises one of a first disk and a  
6           second disk; and  
7           distinguishing the first disk from the second disk according to a magnitude of the  
8           phase difference, wherein the second disk comprises a density higher than the first disk.

1           9. The method as recited in claim 8, wherein the distinguishing determines the first  
2           disk if the phase difference is greater than or equal to a reference phase difference.

3           10. The method as recited in claim 8, wherein the distinguishing determines the  
4           second disk if the phase difference is less than a reference phase difference.

1           11. The method as recited in claim 8, further comprising  
2           generating a first track cross signal from an envelope of an RF SUM signal, wherein  
3           the RF SUM signal is obtained by adding the light receiving signals;  
4           generating a second track cross signal from an envelope of the radial push-pull  
5           signal; and  
6           selectively outputting one of the first track cross signal and the second track cross  
7           signal according to the distinguishing of the first disk from the second disk.

1 12. A method, comprising:  
2 obtaining a magnitude of a phase difference between an upper envelope signal of a  
3 radial push-pull signal and a lower envelope signal of the radial push-pull signal and  
4 determining a type of disk therefrom.

1 13. The method as recited in claim 12, further comprising  
2 dividing a photodetector into at least two light receiving sections in a radial  
3 direction; and  
4 generating the radial push-pull signal from a difference between light receiving  
5 signals from a disk and received by the at least two light receiving sections, wherein the  
6 disk comprises one of a first disk and a second disk.

1 14. The method as recited in claim 13, further comprising  
2 receiving the magnitude of the phase difference and the light receiving signals and  
3 outputting servo error signals;  
4 using the servo error signals to output a voltage to drive a spindle motor of the disk.

1 15. The method as recited in claim 14, further comprising  
2 generating a first track cross signal from an envelope of an RF SUM signal, wherein  
3 the RF SUM signal is obtained by adding the light receiving signals;  
4 generating a second track cross signal from an envelope of the radial push-pull  
5 signal; and  
6 selectively outputting one of the first track cross signal and the second track cross  
7 signal according to the distinguishing of the first disk from the second disk.

1 16. A method generating a track cross signal in an optical disk  
2 recording/reproducing device comprising a photodetector divided into at least two light  
3 receiving sections in a radial direction, comprising:  
4 generating a first track cross signal from an envelope of an RF SUM signal, wherein  
5 the RF SUM signal is obtained by adding light receiving signals from the at least two light  
6 receiving sections;  
7 generating a second track cross signal from an envelope of a radial push-pull signal,  
8 wherein the radial push-pull signal is obtained from a difference between the light receiving

9 signals from a disk and received by the at least two light receiving sections and wherein the  
10 disk comprises a first disk and a second disk;  
11 distinguishing the first disk from the second disk and outputting a signal indicative  
12 thereof, wherein the second disk comprises a density higher than the first disk; and  
13 selectively outputting one of the first track cross signal and the second track cross  
14 signal according to the output signal from the distinguishing.

1 17. The method as recited in claim 16, wherein the distinguishing determines the  
2 first disk if the phase difference is greater than or equal to a reference phase difference.

1 18. The method as recited in claim 16, wherein the distinguishing determines the  
2 second disk if the phase difference is less than a reference phase difference.

1 19. The method of claim 16, wherein the distinguishing:  
2 detecting an upper envelope signal from the radial push-pull signal;  
3 detecting a lower envelope signal from the radial push-pull signal; and  
4 detecting a phase difference between the upper envelope signal and the lower  
5 envelope signal,  
6 wherein the distinguishing determines the first disk from the second disk according  
7 to a magnitude of the phase difference.

1 20. An apparatus determining a type of disc in an optical disc recording/reproducing  
2 device comprising a photodetector divided into at least two light receiving sections in a  
3 radial direction, comprising:

4 a radial subtractor generating a radial push-pull signal from a difference between  
5 light receiving signals from a disk and received by the at least two light receiving sections,  
6 wherein the disk comprises one of a first disk and a second disk;

7 an upper envelope detector detecting an upper envelope signal from the radial push-  
8 pull signal;

9 a lower envelope detector detecting a lower envelope signal from the radial push-  
10 pull signal;

11 a phase comparator detecting a phase difference between the upper envelope signal  
12 and the lower envelope signal; and

13 a type of disk determiner the first disk from the second disk according to a  
14 magnitude of the phase difference and outputting a signal indicative thereof, wherein the  
15 second disk comprises a density higher than the first disk.

1 21. The apparatus as recited in claim 20, wherein the radial push-pull signal is an  
2 RF signal.

1 22. The apparatus as recited in claim 20, wherein the type of disk determiner  
2 determines the first disk if the phase difference is greater than or equal to a reference phase  
3 difference.

1 23. The apparatus as recited in claim 20, wherein the type of disk determiner  
2 determines the second disk if the phase difference is less than a reference phase difference.

1 24. The apparatus as recited in claim 20, further comprising  
2 a servo error generator and servo controller receiving the magnitude of the phase  
3 difference and the light receiving signals and outputting servo error signals;  
4 a servo driver amplifier receiving the servo error signals to output a voltage to drive  
5 a spindle motor of the disk.

1 25. The apparatus as recited in claim 20, further comprising a first comparator  
2 comparing the upper envelope signal with a predetermined threshold and binarizing the  
3 upper envelope signal prior to detecting the phase difference.

1 26. The apparatus as recited in claim 20, further comprising a second comparator  
2 comparing the lower envelope signal with a predetermined threshold and binarizing the  
3 lower envelope signal prior to detecting the phase difference.

1 27. The apparatus as recited in claim 20, further comprising  
2 a first track cross signal generator generating a first track cross signal from an  
3 envelope of an RF SUM signal, wherein the RF SUM signal is obtained by adding the light  
4 receiving signals;  
5 a second track cross signal generator generating a second track cross signal from an  
6 envelope of the radial push-pull signal; and

7 a switch selectively outputting one of the first track cross signal and the second track  
8 cross signal according to the output signal from the type of disk determiner.

1 28. An apparatus, comprising:  
2 a phase comparator detecting a phase difference between an upper envelope signal  
3 and a lower envelope signal from a radial push-pull signal, wherein the radial push-pull  
4 signal is a difference between at least two light receiving signals from a disk and received  
5 by at least two light receiving sections in a photodetector, wherein the disk comprises one  
6 of a first disk and a second disk; and  
7 a type of disk determiner distinguishing the first disk from the second disk  
8 according to a magnitude of the phase difference and outputting a signal indicative thereof,  
9 wherein the second disk comprises a density higher than the first disk.

1 29. The apparatus as recited in claim 28, wherein the type of disk determiner  
2 determines the first disk if the phase difference is greater than or equal to a reference phase  
3 difference.

1 30. The apparatus as recited in claim 28, wherein the type of disk determiner  
2 determines the second disk if the phase difference is less than a reference phase difference.

1 31. The apparatus as recited in claim 28, further comprising  
2 a first track cross signal generator generating a first track cross signal from an  
3 envelope of an RF SUM signal, wherein the RF SUM signal is obtained by adding the light  
4 receiving signals;  
5 a second track cross signal generator generating a second track cross signal from an  
6 envelope of the radial push-pull signal; and  
7 a switch selectively outputting one of the first track cross signal and the second track  
8 cross signal according to the output signal from the type of disk determiner.

1 32. An apparatus, comprising:  
2 a type of disk determiner obtaining a magnitude of a phase difference between an  
3 upper envelope signal of a radial push-pull signal and a lower envelope signal of the radial  
4 push-pull signal and determining therefrom the type of disk and outputting a signal  
5 indicative thereof.

1 33. The apparatus as recited in claim 32, further comprising  
2 a photodetector divided into at least two light receiving sections in a radial direction;  
3 and  
4 a radial push-pull signal generator generating the radial push-pull signal from a  
5 difference between light receiving signals generated by the at least two light receiving  
6 sections.

1 34. The apparatus as recited in claim 33, further comprising  
2 an upper envelope detector detecting the upper envelope signal from the radial push-  
3 pull signal; and  
4 a lower envelope detector detecting the lower envelope signal from the radial push-  
5 pull signal.

1 35. The apparatus as recited in claim 34, further comprising  
2 a servo error generator and servo controller receiving the magnitude of the phase  
3 difference and the light receiving signals and outputting servo error signals;  
4 a servo driver amplifier receiving the servo error signals to output a voltage to drive  
5 a spindle motor of the disk.

1 36. The apparatus as recited in claim 35, further comprising  
2 a first track cross signal generator generating a first track cross signal from an  
3 envelope of an RF SUM signal, wherein the RF SUM signal is obtained by adding the light  
4 receiving signals;  
5 a second track cross signal generator generating a second track cross signal from an  
6 envelope of the radial push-pull signal; and  
7 a switch selectively outputting one of the first track cross signal and the second track  
8 cross signal according to the output signal from the type of disk determiner.

1 37. The apparatus as recited in claim 32, wherein the type of disk is one of a first  
2 disk and a second disk, wherein the second disk comprises a higher density than the first  
3 disk.

1           38. An apparatus generating a track cross signal in an optical disk  
2 recording/reproducing device and comprising a photodetector divided into at least two light  
3 receiving sections in a radial direction, comprising:  
4           a first track cross signal generator generating a first track cross signal from an  
5 envelope of an RF SUM signal, wherein the RF SUM signal is obtained by adding light  
6 receiving signals from the at least two light receiving sections;  
7           a second track cross signal generator generating a second track cross signal from an  
8 envelope of a radial push-pull signal, wherein the radial push-pull signal is obtained from a  
9 difference between the light receiving signals from a disk and received by the at least two  
10 light receiving sections and wherein the disk comprises a first disk and a second disk;  
11           a type of disk determiner distinguishing the first disk from the second disk and  
12 outputting a signal indicative thereof, wherein the second disk comprises a density higher  
13 than the first disk; and  
14           a switch selectively outputting one of the first track cross signal and the second track  
15 cross signal according to the output signal from the type of disk determiner.

1           39. The apparatus of claim 38, wherein the type of disk determiner distinguishes the  
2 first disk from the second disk according to a magnitude of a phase difference between an  
3 upper envelope signal of the radial push-pull signal and a lower envelope signal of the  
4 radial push-pull signal.

1           40. The apparatus of claim 38, wherein the type of disk determiner comprises:  
2           an upper envelope detector detecting an upper envelope signal from the radial push-  
3 pull signal;  
4           a lower envelope detector detecting a lower envelope signal from the radial push-  
5 pull signal; and  
6           a phase comparator detecting a phase difference between the upper envelope signal  
7 and the lower envelope signal,  
8           wherein the type of disk determiner distinguishes the first disk from the second disk  
9 according to a magnitude of the phase difference.